A Performance Analysis of AUTONAV GPS Orbit Determination

Sien Wu, Winy Bertiger, Ron Muellerschoen and Stephen Lichten

Jet Propulsion Laboratory
California Institute of Technology

The GPS ephemerides and clocks are currently determined with ground monitor stations and uploaded by the Operation Control Segment (OCS) to each sate]] ite. The ephemeris and clock information is then broadcast to the user for positioning using GPS. Frequent ground contacts are essential to maintain a reasonable GPS ephemeris accuracy. A daily upload is nominal. The up-coming Block IIR GPS satellites will have the capability of autonomous navigation (AUTONAV) using two-way interlink ranging between all satellites in view. This capability would ease the need for frequent ground contacts and, at the same time, further enhance the ephemeris and clock accuracy. A time between uploads of up to 180 days has been proposed, This paper carries out an analysis investigating the expected performance of AUTONAV GPS orbit determination. Different estimation scenarios for better orbit determination and prediction are studied. The variations include different treatments of process-noise modeling for solar radiation pressure and gravity; the data update time and prediction period; and the use of local versus global ranging data. The analysis provides an error budget for GPS AUTONAV with a detailed examination of the relative error contributions from random and systematic errors, as well as an assessment of the effect of errors in the latest upload from the ground. The implication to user range error (URE) will also be derived. The results will provide significant information on the degree of complexity required for the onboard estimation filter, the amount of information exchange between. satellites, the frequency of estimation process and the frequency of ground upload to maintain a specified ephemeris accuracy.

Proposed Session: Cl: Space Applications

Send reply to:	Dr. Sien-Chong Wu	*or*	Dr. Stephen M. Lichten
	M/S 238-600		M/S 238-600
	Jet Propulsion Laboratory		Jet Propulsion Laboratory
	4800 Oak Grove Drive		4800 Oak Grove Drive
	Pasadena, CA 91109		Pasadena, CA 91109
Telephone:	(818) 354-4937		(818) 354-1614
Fax:	(81 8) 393-4965		(81 8) 393-4965
Email:	scw@cobra.jpl.nasa.gov		sl@cobra.jpl.nasa.gov